Small Business Innovation Research/Small Business Tech Transfer

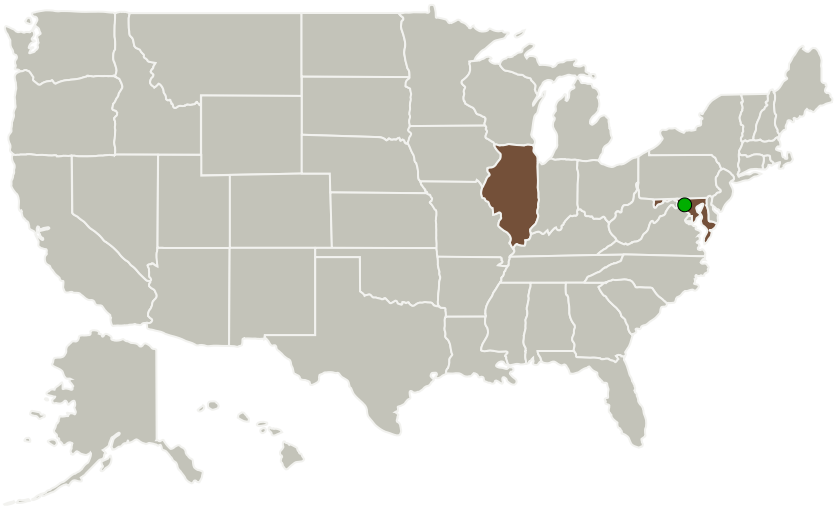
Design and Fabrication of Strain-Balanced nBn Dual-Band LWIR/LWIR Focal Plane Arrays Based on InAsSb/InAsType-II Superlattices, Phase I

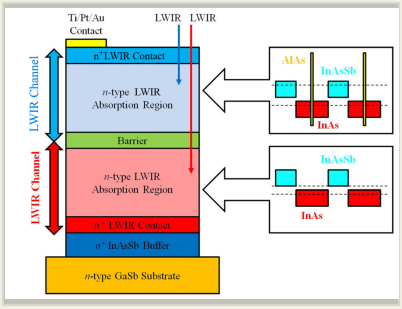
Completed Technology Project (2015 - 2016)

Project Introduction

The infrared spectral range is of particular interest for remote planetary sensing of gaseous molecules, such as H2O, CO2, CH4, N2O, CO, NH3, and many other compounds. Infrared thermography can also be used to accurate measure minute variations in surface temperatures. High performance infrared focal plane arrays (FPAs) allow rapid acquisition of a 2D surface maps--indispensable in planetary sciences. By using two different cut-off detectors integrated into a single FPA to simultaneously image a planet we can avoid atmospheric effect and much more accurately map minute variations in the surface temperature, or gain a clearer picture of the atmospheric composition. In recent years, Type-II InAs/GaSb superlattices have experienced significant development—we have played a pioneering role in the rapid development of that technology. However, the full potential of Type-II superlattice has not been fully explored and alternate superlattice architectures hold great promise; one of the most promising is gallium free InAsSb/InAs Type-II superlattices. In this project, we propose to study strain-balanced nBn InAs1-xSbx/InAs Type-II superlattice-based photodetectors and mini-arrays for LWIR/LWIR dual-band detection. Using this new superlattice structure, it is expected to achieve longer minority carrier lifetime. Longer minority carrier lifetime results in lower dark current, lower noise, higher operation temperature, and higher quantum efficiency. Applying this superlattice design to dual-band LWIR/LWIR FPAs, it is expected to achieve higher quantum efficiency, lower dark current, higher specific detectivity (D*) and reduced Noise Equivalent Temperature Difference (NETD). This work will form the basis of the Phase II work in which we will use this new superlattice structure to develop and deliver LWIR/LWIR dual-band FPAs for planetary sciences.

Primary U.S. Work Locations and Key Partners





Design and fabrication of strain-balanced nBn dual-band LWIR/LWIR focal plane arrays based on InAsSb/InAsType-II superlattices, Phase I Briefing Chart Image

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Nour, LLC	Lead Organization	Industry Women-Owned Small Business (WOSB)	Wilmette, Illinois
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland
Northwestern University	Supporting Organization	Academia	Evanston, Illinois

Primary U.S. Work Locations	
Illinois	Maryland

Project Transitions

June 2015: Project Start

June 2016: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138919)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nour, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

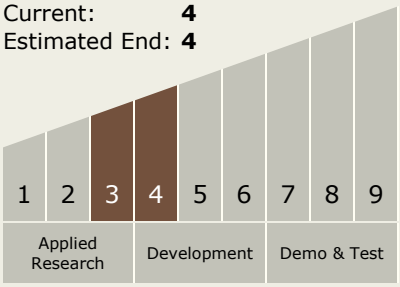
Carlos Torrez

Principal Investigator:

Ryan Mcclintock

Technology Maturity (TRL)

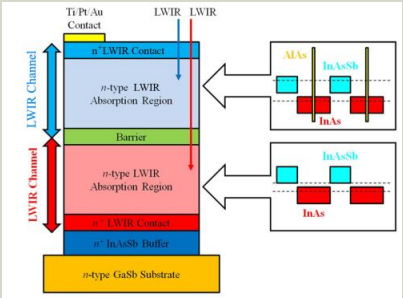
Start: **3**
Current: **4**
Estimated End: **4**



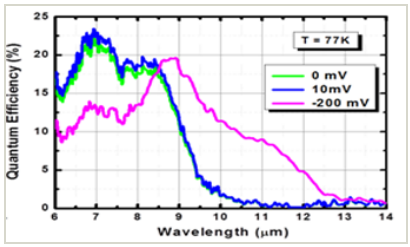
Design and Fabrication of Strain-Balanced nBn Dual-Band LWIR/LWIR Focal Plane Arrays Based on InAsSb/InAsType-II Superlattices, Phase I

Completed Technology Project (2015 - 2016)

Images



Briefing Chart Image
Design and fabrication of strain-balanced nBn dual-band LWIR/LWIR focal plane arrays based on InAsSb/InAsType-II superlattices, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/129674)



Final Summary Chart Image
Design and fabrication of strain-balanced nBn dual-band LWIR/LWIR focal plane arrays based on InAsSb/InAsType-II superlattices, Phase I Project Image
(https://techport.nasa.gov/image/135064)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System